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goddardview

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NASA and OPTIMUS PRIME Collaborate to Educate Youth

By Rani Gran

NASA has developed a contest to raise students' awareness of technology transfer efforts and how NASA technologies contribute to our everyday lives.

NASA is collaborating with Hasbro using the correlation between the popular Transformers brand, featuring its leader OPTIMUS PRIME, and spinoffs from NASA technologies created for aeronautics and space missions that are used here on Earth. The goal is to help students understand that NASA technology 'transforms' into things that are used daily. These transformed technologies include water purifiers, medical imaging software, or fabric that protects against UV rays.

Image courtesy Hasbro

The Innovative Partnerships Program Office at Goddard, in conjunction with NASA's Office of Education, has designed a video contest for students from third to eighth grade. Each student, or group of students, will submit a three- to five-minute video on a selected NASA spinoff technology listed in the 2009 Spinoff publication. Videos must demonstrate an understanding of the NASA spinoff technology and the associated NASA mission, as well as the commercial application and public benefit associated with the "transformed" technology. Video entries are due by December 31.

The videos will be posted on the NASA YouTube channel, and the public will be responsible for the first round of judging. The top five submissions from each of the two grade groups (third-fifth and sixth-eighth) will advance for final judging. A NASA panel will select a winning entry from each group, and the students will receive an OPTIMUS PRIME Spinoff Award at the Space Foundation's National Space Symposium in 2011. The innovators of the NASA technology highlighted in the winning videos also will receive trophies, along with their commercial partners. ■

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Cover caption: Artist's conception of the MAVEN spacecraft orbiting Mars.

Image credit: NASA/Goddard Space Flight Center.

GoddardView Info

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NASA'S Mars Atmosphere Mission Gets Green Light to Proceed to Development

By Nancy Neal Jones and Bill Steigerwald

NASA's mission to investigate the mystery of how Mars lost much of its atmosphere passed a critical milestone on October 4, 2010. NASA has given approval for the development and 2013 launch of the *Mars Atmosphere and Volatile Evolution* (MAVEN) mission.

Clues on the Martian surface, such as features resembling dry riverbeds and minerals that only form in the presence of liquid water, suggest that Mars once had a denser atmosphere, which supported the presence of liquid water on the surface. As part of a dramatic climate change, most of the Martian atmosphere was lost. MAVEN will make definitive scientific measurements of present-day atmospheric loss that will offer insight into the Red Planet's history.

Michael Luther, on behalf of Dr. Ed Weiler, of the NASA Headquarters Science Mission Directorate, led a confirmation review panel that approved the detailed plans, instrument suite, budget, and risk factor analysis for the spacecraft.

"A better understanding of the upper atmosphere and the role that escape to space has played is required to plug a major hole in our understanding of Mars. We're really excited about having the opportunity to address these fundamental science questions," said MAVEN Principal Investigator, Dr. Bruce Jakosky, of the Laboratory for Atmospheric and Space Physics at the University of Colorado (CU-LASP) at Boulder.

"The team has successfully met every major milestone since selection two years ago," said MAVEN Project Manager David Mitchell of Goddard. "Looking forward, we are well positioned for the next push to critical design review in July 2011. In three short years, we'll be heading to Mars!"

The confirmation review, formally known as "Key Decision Point C," authorized continuation of the project into the development phase and set its cost and schedule. The next major mission milestone, the critical design review, will examine the detailed MAVEN system design. After a successful critical design review, the project team will assemble the spacecraft and its instruments.

Photo credit: NASA/Goddard

Caption: David Mitchell, MAVEN Project Manager, and Dr. Bruce Jakosky, MAVEN Principal Investigator, in front of the Goddard electronic gate sign.

"This project is a vital complement to past, present, and future Mars missions," said Dr. Michael Meyer, lead Mars Scientist for NASA's Mars Exploration Program in Washington. "MAVEN will take us a step closer in learning about the evolution of our intriguing celestial neighbor."

Goddard will manage the project, which will cost $438 million excluding the separately government-furnished launch vehicle and telecommunications relay package. Goddard will also build some of the instruments for the mission. In addition to the PI coming from CU-LASP, the university will provide science operations, build instruments, and lead education/public outreach. Lockheed Martin of Littleton, Colo., will build the spacecraft based on designs from NASA's *Mars Reconnaissance Orbiter* and 2001 *Mars Odyssey* missions and perform mission operations. The University of California-Berkeley Space Sciences Laboratory will also build instruments for the mission. NASA's Jet Propulsion Laboratory, Pasadena, Calif., will provide navigation support, the Deep Space Network, and the Electra telecommunications relay hardware and operations.

For more about MAVEN, visit: http://www.nasa.gov/maven. ■

Cluster Helps Disentangle Turbulence in the Solar Wind

By Karen C. Fox

From Earth, the Sun looks like a calm, placid body that does little more than shine brightly while marching across the sky. Images from a bit closer, however, show it's an unruly ball of hot gas that can spit long plumes out into space—but even this isn't the whole story. Surrounding the Sun is a roiling wind of electrons and protons that shows constant turbulence at every size scale: long streaming jets, smaller whirling eddies, and even microscopic movements as charged particles circle in miniature orbits. Through it all, great magnetic waves and electric currents move through, stirring up the particles even more.

This solar wind is some million degrees Celsius, can move as fast as 750 kilometers (466 statute miles) per second, and—so far—defies a complete description by any one theory. It's hotter than expected, for one, and no one has yet agreed which of several theories offers the best explanation.

Now, the European Space Agency (ESA)/NASA *Cluster* mission—four identical spacecraft that fly in a tight formation to provide 3-dimensional snapshots of structures around Earth—has provided new information about how the protons in the solar wind are heated.

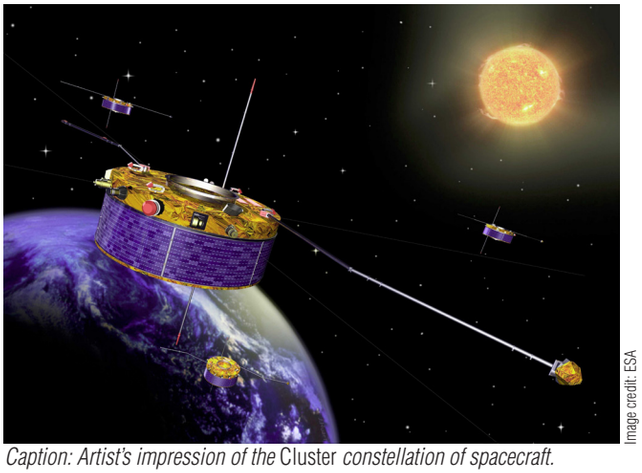

Image credit: ESA

Caption: Artist's impression of the Cluster *constellation of spacecraft.*

"We had a perfect window of 50 minutes," says NASA scientist Melvyn Goldstein, Chief of the Geospace Physics Laboratory at Goddard and co-author of the new paper that appeared in Physical Review Letters on September 24, 2010. "It was a time when the four *Cluster* spacecraft were so close together, they could watch movements in the solar wind at a scale small enough that it was possible to observe the heating of protons through turbulence directly for the first time. "

Scientists know that large turbulence tends to "cascade" down into smaller turbulence—imagine the sharply defined whitecaps on top of long ocean waves. In ocean waves, the energy from such cascades naturally adds a small amount of heat from friction as the particles shift past each other, thus heating the water slightly. But the fast, charged particles—known as plasma—around the Sun don't experience that kind of friction, yet they heat up in a similar way.

"Unlike the usual fluids of everyday life," says Fouad Sahraoui, lead author of a new paper on the solar wind and a scientist at the Centre National de la Recherche Scientifique (CNRS)-Ecole Polytechnique-L'université Pierre et Marie Curie (UPMC) in France, "plasmas possess electric and magnetic fields generated by the motions of proton and electrons. This changes much of the intuitive images that we get from observing conventional fluids."

Somehow the magnetic and electric fields in the plasma must contribute to heating the particles. Decades of research on the solar wind have been able to infer the length and effects of the magnetic waves, but direct observation was not possible before *Cluster* watched large waves from afar. These start long as long wavelength fluctuations, but lose energy—while getting shorter—over time. Loss of energy in the waves transfer energy to the solar wind particles, heating them up, but the exact method of energy transfer, and the exact nature of the waves doing the heating, has not been completely established.

In addition to trying to find the mechanism that heats the solar wind, there's another mystery: the magnetic waves transfer heat to the particles at different rates depending on their wavelength. The largest waves lose energy at a continuous rate until they make it down to about 100 kilometer wavelength. They then lose energy even more quickly before they hit around 2 kilometer wavelength and return to more or less the previous rate. To tackle these puzzles, scientists used data from *Cluster* when it was in the solar wind in a position where it could not be influenced by Earth's magnetosphere.

For this latest paper, the four *Cluster* spacecraft provided 50 minutes of data at a time when conditions were just right—the spacecraft were in a homogenous area of the solar wind, they were close together, and they formed a perfect tetrahedral shape—such that the instruments could measure electromagnetic waves in three dimensions at the small scales that affect protons.

The measurements showed that the cascade of turbulence occurs through the action of a special kind of traveling waves—named Alfvén waves after Nobel laureate Hannes Alfvén, who discovered them in 1941.

The surprising thing about the waves that *Cluster* observed is that they pointed perpendicular to the magnetic field. This is in contrast to previous work from the Helios spacecraft, which in the 1970s examined magnetic waves closer to the Sun. That work found magnetic waves running parallel to the magnetic field, which can send particles moving in tight circular orbits—a process known as cyclotron resonance—thus giving them a kick in both energy and temperature. The perpendicular waves found here, on the other hand, create electric fields that efficiently transfer energy to particles by, essentially, pushing them to move faster.

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Cluster Helps Disentangle Turbulence in the Solar Wind

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Indeed, earlier *Cluster* work suggested that this process—known as Landau damping—helped heat electrons. But, since much of the change in temperature with distance from the Sun is due to changes in the proton temperature, it was crucial to understand how they obtained their energy. Since hot electrons do not heat protons very well at all, this couldn't be the mechanism.

That Landau damping is what adds energy to both protons and electrons—at least near Earth—also helps explain the odd rate change in wave fluctuations as well. When the wavelengths are about 100 kilometers or a bit shorter, the electric fields of these perpendicular waves heat protons very efficiently. So, at these lengths, the waves transfer energy quickly to the surrounding protons—offering an explanation why the magnetic waves suddenly begin to lose energy at a faster rate. Waves that are about two kilometers, however, do not interact efficiently with protons because the electric fields oscillate too fast to push them. Instead these shorter waves begin to push and heat electrons efficiently and quickly deplete all the energy in the waves.

"We can see that not all the energy is dissipated by protons," Sahraou said. "The remaining energy in the wave continues its journey toward smaller scales, wavelengths of about two kilometers long. At that point, electrons in turn get heated."

Future NASA missions such as the *Magnetospheric Multiscale* mission, scheduled for launch in 2014, will be able to probe the movements of the solar wind at even smaller scales.

Cluster recently surpassed a decade of passing in and out of our planet's magnetic field, returning invaluable data to scientists worldwide. Besides studying the solar wind, *Cluster*'s other observations include studying the composition of the Earth's aurora and its magnetosphere.

For more information on *Cluster*, visit:
http://science.nasa.gov/missions/cluster. ■

Mobile Mars Laboratory Almost Ready for Flight

By Cynthia O'Carroll

The Sample Analysis at Mars (SAM) instrument suite has completed assembly at Goddard and is nearly ready for a December delivery to NASA's Jet Propulsion Laboratory (JPL), Pasadena, Calif., where it will be joined to the Curiosity rover. SAM and Curiosity are set to fly on the upcoming Mars Science Laboratory (MSL) rover mission scheduled for launch in the fall of 2011.

SAM will become an automated, mobile laboratory as it is carried across Mars by the rover when the mission arrives at the Red Planet in 2012. Together with other instruments on Curiosity, SAM will assess whether Mars ever was, or is still today, an environment able to support microbial life.

"We expect Curiosity will make amazing discoveries," said SAM Principal Investigator Dr. Paul Mahaffy of Goddard, "and we are looking forward to the contributions our mobile chemistry laboratory can make to a better understanding of the history of our neighboring planet."

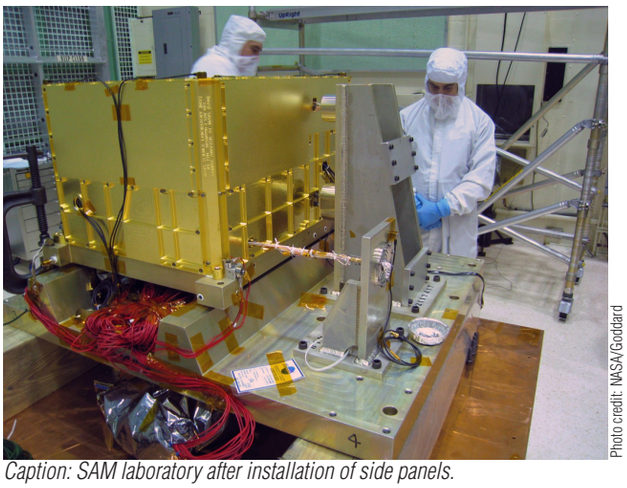

Photo credit: NASA/Goddard

Caption: SAM laboratory after installation of side panels.

SAM is in flight configuration, meaning its instruments are in the condition they will be during launch and are ready to begin operations on Mars. The instrument suite (a mass spectrometer, gas chromatograph, and tunable laser spectrometer) has started final environmental testing this week, which includes vibration and thermal testing to ensure SAM can survive the launch, deep space flight, and conditions on Mars.

Once at Mars, SAM will examine the planet's habitability by exploring molecular and elemental chemistry relevant to life. SAM will analyze samples of Martian rock and soil to assess carbon chemistry through a search for organic compounds. The lab will also determine the chemical state of light elements other than carbon, and look for isotopic tracers of planetary change.

JPL manages the Mars Science Laboratory project for NASA's Science Mission Directorate. SAM was built by Goddard using significant elements provided by industry, university, and NASA partners. ■

NASA Makes the Invisible Visible in Medical Imaging

By Lori J. Keesey

A technology that Goddard computer engineer James Tilton originally conceived for analyzing remote-sensing imagery could one day aid in the interpretation of mammograms, ultrasounds, and other medical imaging.

A Connecticut-based company, Bartron Medical Imaging, Inc., adapted Tilton's advanced computer algorithm—Recursive Hierarchical Segmentation Software (RHSEG)—for use in its MED-SEG™ system. The Food and Drug Administration (FDA) recently cleared the system for use by radiologists to process images for reports and communications. However, FDA has not yet cleared it as a primary diagnostic tool. Clinical trials are expected to begin shortly. "The use of this computer-based technology could minimize human error that occurs when evaluating radiologic films and might allow for earlier detection of abnormalities within the tissues being imaged," said Thomas Rutherford, director of gynecologic oncology at Yale University.

Photo credit: NASA/Goddard/Chris Gunn

Caption: Goddard computer engineer James Tilton.

Tilton began working on his algorithm more than 25 years ago. His goal was to advance a totally new approach for analyzing digital images, which are made up of thousands of pixels. Like a single piece of a jigsaw puzzle, a pixel often does not provide enough information about where it fits into the overall scene. To overcome the deficiency, Tilton focused on an approach called image segmentation, which organizes and groups an image's pixels together at different levels of detail.

For example, a remote-sensing image may contain several lakes of different depths. Deep lakes appear dark blue, while shallow lakes are a lighter shade of blue. RHSEG first finds each individual lake; then it groups together all shallow lakes into one class and the deeper lakes into another. Because lakes are more similar to each other than they are to trees, grass, roads, buildings, and other objects, the software then groups all lakes together, regardless of their varying colors. As a result, RHSEG allows the user to distinguish important features in the scene accurately and quickly.

Since Tilton developed the algorithm, scientists have used it to improve the accuracy of snow and ice maps produced from data gathered by NASA's *Landsat* and *Terra* spacecraft. Scientists also have used it to find potential archeological sites, the premise being that vegetation covering an abandoned human settlement would look different than surrounding flora.

"My concept was geared to Earth science," Tilton said. "I never thought it would be used for medical imaging." In fact, he initially was skeptical; that is, until he processed cell images and saw details not visible in unprocessed images. "The cell features stood out clearly and made me realize that Bartron was onto to something."

Bartron learned of the patented software through Goddard's Innovative Partnerships Program Office, and in 2003 licensed it to create a system that would differentiate hard-to-see details in complex medical images. Through a NASA agreement, Tilton also worked with the company to develop, test, and document a new three-dimensional version of RHSEG that Bartron plans to incorporate into a next-generation product.

Tilton, meanwhile, said he'll remain focused on applying his technology to other Earth science-related applications and has used Goddard R&D funding to achieve that end. "The main point was and is to help us understand Earth imagery, but knowing that it may help people receive improved health care is very exciting."

For more information about Goddard's Innovative Partnerships Program Office, visit: http://ipp.gsfc.nasa.gov. ■

Two Goddard *Fermi Telescope* Scientists Win Lindsay Awards

By Lynn Chandler

Two scientists on the *Fermi Gamma-ray Space Telescope* mission employed at Goddard were recipients of the 45th annual John C. Lindsay Memorial Award last week. The award was bestowed upon Dr. Julie McEnery and Dr. David Thompson.

Dr. Nicholas White, Director of the Sciences and Exploration Directorate at Goddard, was the emcee of the award ceremony on October 8, 2010. White said, "The scientific leadership of both Julie and Dave were key to pulling off this very challenging mission and I am extremely pleased to see this recognized with Goddard's highest award."

Photo credit: NASA/Goddard/Debora McCallum

Caption: David Thompson and Julie McEnery stand with their awards in between Rock Obenschain (far left) and Nick White (far right).

The John C. Lindsay Memorial Award for Space Science is an annual award, and is the highest space science award that Goddard bestows. It is named for Dr. John C. Lindsay, who joined Goddard on December 28, 1958 and pioneered the exploration of the Sun by both satellite and rocket-borne experiments. He served as Associate Chief of the Space Sciences Division and headed the Goddard Solar Physics Program. Dr. Lindsay also conceived and directed the *Orbiting Solar Observatory* project and was the manager of several *Explorer* and *Pioneer* missions.

The Lindsay Award is presented to employees who best exhibit the qualities of broad scientific accomplishments in the area of space science. The award commemorates the launch of the first *Orbiting Solar Observatory* (OSO) in 1962, a great accomplishment for Lindsay and those who worked with him.

Both McEnery and Thompson were recognized for two years of discovery with the *Fermi Gamma-ray Space Telescope*. Both noted that they accepted the award on behalf of the many scientists and engineers from various organizations around the world who worked on *Fermi*.

Gamma rays, the most energetic photons, help explore some of the most extreme phenomena in the universe. In its more than two years of operation, the *Fermi Gamma-ray Space Telescope* has surveyed the entire sky approximately eight times per day, producing a wide range of discoveries.

Julie McEnery is the *Fermi* Project Scientist and an astrophysicist in the Astroparticle Physics Laboratory at Goddard. Julie has spent her career working in high-energy gamma-ray and cosmic-ray astrophysics. She has served as the analysis coordinator for the *Fermi* Large Area Telescope and is responsible for coordinating gamma-ray burst operations across the *Fermi* mission.

In addition to working on *Fermi*, she continues her involvement in the ground-based gamma-ray observatories Whipple, Very Energetic Radiation Imaging Telescope Array System (VERITAS), Milagro, and the High Altitude Water Cherenkov (HAWC) Experiment. Julie received her B.S. in physics with astrophysics from the University of Manchester and her Ph.D. in physics from University College Dublin. Her science interests center on active galaxies and gamma-ray bursts, but she also explores interesting topics in other areas. Julie is a resident of College Park, Md.

"It is a pleasure to receive a Lindsay award marking the science return from the first two years of Fermi Gamma-Ray Space Telescope, and is exciting to think that we are less than half way through the mission and have many more exciting discoveries ahead of us," McEnery said.

David J. Thompson is a Goddard astrophysicist who has worked on three satellites studying the gamma-ray sky: Small Astronomy Satellite (SAS-2), Compton Gamma Ray Observatory, and Fermi Gamma-ray Space Telescope. He is currently a Deputy Project Scientist for the Fermi project, the Multiwavelength Coordinator for the Fermi Large Area Telescope, and a co-lead of the Catalog Science Group for that instrument. He is a graduate of the Johns Hopkins University and the University of Maryland. In addition to the satellites, he helped lead studies with balloon-borne prototypes of instruments for all three missions. His particular scientific interests are gamma-ray pulsars and blazars. David is a resident of Bowie, Md.

Thompson commented, "Having the Fermi gamma-ray astronomy results recognized with the Lindsay Award is particularly gratifying, since the first map of the gamma-ray sky came from an instrument on OSO-3, one of Dr. Lindsay's projects."

For more information about the Fermi Gamma-ray Space Telescope, visit: http://www.nasa.gov/fermi.

For more information about Dr. Julie McEnery, visit: http://www.nasa.gov/mission_pages/GLAST/team/Julie_Mc_Enery-bio.html.

For more information about Dr. David Thompson, visit: http://www.nasa.gov/mission_pages/GLAST/team/thompson-bio.html. ■

James Webb Space Telescope…Smashingly Cold

By Rob Gutro

Imagine a place colder than Pluto where rubber can be shattered like glass, where most gasses are liquid, and where living things would become frozen solid. One million miles from Earth is that place and that's where the *James Webb Space Telescope* is going. A recent NASA demonstration showed a television audience just what would happen to a material like rubber if it were at that same place.

Scientists had to create that kind of an environment here on Earth so they could test the materials that make up the *James Webb Space Telescope*, which is currently being built. Testing pieces of the telescope are important to ensure they will work properly in the frigid temperatures of deep space.

The *Webb Telescope* is the next-generation premier space observatory, exploring deep space phenomena from distant galaxies to nearby planets and stars. The *Webb Telescope* will give scientists clues about the formation of the universe and the evolution of our own solar system, from the first light after the Big Bang to the formation of star systems capable of supporting life on planets like Earth. The icy cold place where the *Webb Telescope* will orbit is called a "Lagrange point," about one million miles from Earth. *Webb*'s components need to survive temperatures that plunge as low as -411 degrees Fahrenheit (27 Kelvin).

On October 7, 2010, four NASA scientists and engineers took turns demonstrating to television audiences around the U.S. what happens to a piece of rubber material in temperatures almost as cold as those *Webb* will endure in space. The four scientists were Amber Straughn, Jim Pontius, Eric Johnson, and Paul Geithner, all of whom are on the *Webb Telescope* team at Goddard.

The demonstration took place in the television studios at Goddard. Television stations from cities that included Buffalo, N.Y., Orlando, Fla., Washington, D.C., Phoenix, Ariz., Seattle, Wash., and Denver, Colo. were patched into NASA's television studio for a live interview with one of the scientists and the demonstration.

During the individual interviews, each scientist wore protective gloves and safety goggles. They placed a piece of plastic tubing in a cup of liquid nitrogen to recreate the temperatures in space. In each case, the cup of liquid nitrogen was oozing gas down the side of the cup while the plastic tubing in the cup was going through a quick and amazing change.

So, what is liquid nitrogen? It is nitrogen in a liquid state at a very low temperature and is a colorless clear liquid. It can cause rapid freezing on contact with living tissue and may lead to frostbite. It is used in a number of ways. It can be a coolant for cameras in astronomy and for super computers, and it is also used for immersion freezing and transportation of food products as well as having many other uses. Scientists need to be careful using nitrogen in its liquid form because as it evaporates it will reduce the oxygen concentration in the air, especially in confined spaces. Nitrogen is odorless, colorless, and tasteless, and may produce asphyxia without any sensation or prior warning.

During Amber Straughn's on-camera demonstration, seconds after she placed the rubber tubing in the cup of liquid nitrogen she lifted it out of the cup. It was frozen solid. To show the audience that the rubber was frozen inside and out, she then smashed it to bits with a hammer.

Photo credit: NASA/Goddard

Caption: Amber Straughn demonstrates how cold outer space is by immersing a piece of rubber in liquid nitrogen, removing the frozen solid material, then smashing it with a hammer.

"Doing live TV interviews certainly has its challenges since you're put on the spot and what you say is recorded, but these turned out really well and the whole experience was a lot of fun," said Straughn, a NASA Postdoctoral Program Fellow and Lead Scientist for *Webb Telescope* Education and Public Outreach at Goddard. "Who wouldn't love playing with cryogens on live TV?" she said.

What's amazing is how NASA engineers are building a telescope using materials that will keep on working at those frigid temperatures.

There was only one word to describe this demonstration: smashing!

For a more in-depth feature about the unique material NASA engineers made, visit: http://www.nasa.gov/topics/technology/features/jwst-unobtainium.html.

For more information about the *James Webb Space Telescope*, visit: http://www.jwst.nasa.gov.

For more information about the *Webb Telescope*'s orbit, visit: http://www.the Webb Telescope.nasa.gov/orbit.html.

To see the interview on the Washington, D.C. Fox affiliate, visit: http://www.myfoxdc.com/dpp/weather/weather_guy/weather-guys-james-webb-space-telescope-100710. ■

Paid to Have Fun

By Cynthia O'Carroll

Noah Petro still cannot believe that he is getting paid for having so much fun. Petro's wide smile flashes as if he is unwrapping a long anticipated present. "Every day at NASA is different. I get to study data from the surface of the Moon that no one has ever seen before," exclaimed Petro.

Like most little boys, Petro was in awe of his father, Denis, an engineer with the Apollo program during the 1960's. He remembers seeing a test model of an Apollo astronaut backpack in a New York museum and his father whispering that he had worked on these backpacks, each containing a hidden piece of metal with the engineer's signatures etched into it. The astronauts left their backpacks on the Moon—his father's name was actually on the surface of the Moon.

At 31, Petro lovingly credits both his parents for their encouragement to pursue his passions. As an engineer, his father was so intrigued by electrical impulses that he wanted to understand similar impulses in the brain—so he also became a neurologist. His mom, Jane, became an accomplished surgeon. His parents were perfect examples of how to live your dreams. Although his middle school guidance counselor encouraged him to take biology to become a doctor like his parents, Petro was not persuaded. He selected Earth science instead. He knew that he would find his own path, unaware then that it would be covered in rocks.

Petro found that he was drawn to science and geology due to the influence of some very talented science teachers at Fox Lane High School in Mount Kisco, N.Y. They were experienced Earth science field researchers that had studied glaciers, volcanoes, and other geologic features and they shared pictures and tales of adventures with the students. "They helped me realize that there was fun to be had exploring the world and all of its complicated systems," remarked Petro.

One experiment was simple but had a monumental impact on Petro. The instructor used a tank of water and posed one question, "Which will float—the rock or the wood?" Of course everyone guessed the wood, but it was the rock that floated! The rock was made of pumice, a type of volcanic rock that is formed when hot lava cools and it becomes light enough to float. The wood was from an ironwood tree, which is extremely dense and therefore sinks in water.

Noah was intrigued. Now he could see science as more than something in a book; he could feel the connection to the world around him and the Earth beneath his feet.

His passion for geology led him to Bates College in Lewiston, Maine for his undergraduate studies. There, Petro got his hands dirty during a summer internship through NASA's Planetary Geology and Geophysics Undergraduate Research Program (PGGURP) and worked with the United States Geological Survey in Flagstaff, Ariz.

Also at Bates, Petro met Professor Gene Clough, lecturer in geology and physics, who became his dear friend, advisor, role model, and tour guide as he delved into planetary geology.

"I was substituting for another faculty member and decided to discuss the geology of the Moon. Noah introduced himself as being an enthusiastic fan of space exploration with plans to major in geology. That day we began a conversation about the geology of the Moon that never stopped," recalled Clough fondly.

In graduate school at Brown University, Providence, R.I., Petro found another great mentor and lasting friend in Carle Pieter, a professor of geological sciences.

Because of these relationships, Petro takes his current role as a high school mentor seriously. He plans short-term projects so interns can experience the entire scientific process and feel a true sense of accomplishment when they leave NASA.

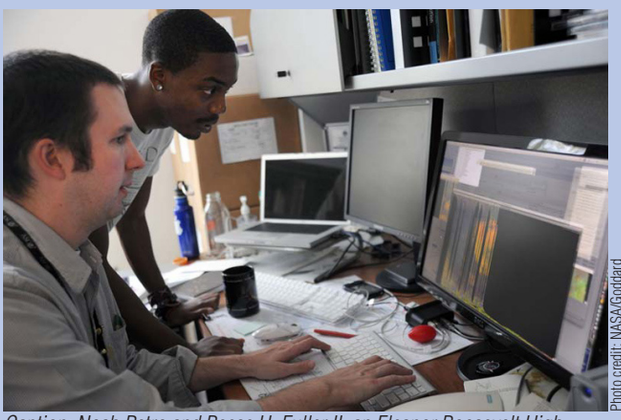

Photo credit: NASA/Goddard

Caption: Noah Petro and Reese H. Fuller II, an Eleanor Roosevelt High School Senior. Fuller is now a student at the University of Maryland-Baltimore County and is considering a career in communications.

"I want to inspire other young people to follow their passions in life, whether it be in science or other fields", Petro stated. "Many thoughtful people inspired me and I feel truly blessed to carry the torch for others."

Petro has definitely found his niche in the Planetary Geodynamics Laboratory at Goddard. Although Petro has only been in there for a few years, he has developed a rather unique skill set focused on lunar technology.

Petro and colleagues have recently investigated a region in the widest and deepest crater on the Moon using the Moon Mineralogy Mapper (M3), a NASA instrument onboard India's *Chandrayaan-1* lunar-orbiting spacecraft. Spectra from this instrument revealed that the formation of the Apollo Basin might have exposed a portion of the Moon's lower crust. The Apollo Basin, at 300 miles in diameter, is located in the northeastern corner of the enormous South Pole-Aitken Basin, which is 1,550 miles in diameter.

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OutsideGoddard: Bluegrass Camp

By Elizabeth M. Jarrell

As a boy, Dr. Drake Deming, the Senior Scientist for Extrasolar Planet Studies, had a guitar, but all he really wanted to do was play the banjo. One summer, he bought a banjo in a pawn shop. He found learning to play the banjo harder than learning to play the guitar because the banjo "has a lot of complex picking patterns and requires more right hand to left hand coordination."

Photo provided by Drak Demin

Caption: Drake Deming with Deering Sierra.

A few years ago, John Annen, a co-worker, took up playing the banjo. Deming went to Annen's house one evening and ended up coming home with a new banjo. The next logical step, obviously, was attending bluegrass banjo camp. He has already attended two of them. According to Deming, "I've never taken weekly, formal lessons from an area instructor. That's why I go to the bluegrass camps where I get a lot of instruction." Although not a singer himself, he plays generally known music so he can always find a singer. He does, however, hum along.

In 2009, Deming spent a week at the NashCamp outside of Nashville, Tennessee, the Nation's center for country, bluegrass, and now other kinds of music making. NashCamp is based at the Drouillard Mansion, which Deming describes as "a lovely location like something out of "Gone with the Wind." Deming said, "It is amazing how many bluegrass camps you can find by Googling 'bluegrass camp.'" Like other bluegrass camps, NashCamp offers instruction in banjo, fiddle, guitar, bass, mandolin, Dobro (a resonator guitar), and singing. The instructors are all from around Nashville and many are national, award-winning players themselves. More importantly, Deming describes then all as being "very patient."

The accommodations were quite lovely. There were three campers to each cabin which had modern plumbing. Food was catered by a leading Nashville restaurant. Deming observes that "you do not go to this camp to lose weight."

A typical day began with a four hour group master class on banjo. After lunch, there was a selection of two hour seminars on specialized topics such as "How to Work Together with Other Instruments in a Band." From later afternoon into the evening, there were impromptu jam sessions. Deming noticed a young boy who kept asking questions during the first seminar. In the middle of a demonstration of a song by the professional instructor, the instructor pointed to the boy who then joined in playing the song on the banjo and then Dobro as well as the instructor. It turns out that this boy was a twelve year old musical prodigy. Deming observes that "The young people really put you in your place. They are really talented. It's not like science. A twelve year old is not going to be comparable to an adult scientist. But in music there are a lot of young prodigies."

Most evenings the campers were treated to concerts by various Nashville professionals on the mansion's wrap-around porch. Deming observed that some of their instructors also participated and that more than a few of them were truly sweating before performing. Deming declared that "the evening concerts were the biggest thrill" of his entire camp experience.
Near the end of the week, the instructors organized the campers into bands. Each band then played two numbers at Nashville's Station Inn, the premier bluegrass club in the world for live performances.

Deming's wife joined him in Nashville for a few days following camp. They attended a performance at the Grand Ole Opry by Little Jimmy Dickens whose signature song for the last 45 years has been "May the Bird of Paradise Fly Up Your Nose." Although neither Deming nor his wife particularly like country music, they both enjoyed the humorous and fun performance.
Later that year, Deming participated in Camp Bluegrass at South Plains College in Levelland, Texas which offers classes in bluegrass and country music as well as certificates in commercial music. This time, Deming spent the week in a dormitory eating institutional food. Camp Bluegrass is headed by Alan Munde, whom Deming describes as "a very, very famous bluegrass banjo player and instructor."

Most days, Deming attended classes in the morning followed by structured jam sessions in the afternoon. "A structured jam is more like band practice with an instructor directing the players," explains Deming. He chose Bill Evans, the author of "Banjo for Dummies," as his instructor and pronounced him to be "the best teacher I've been exposed to." He spent his evenings at concerts given by well known, professional bluegrass musicians.

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OutsideGoddard: Bluegrass Camp

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Deming is already thinking about his next bluegrass camp, which may be located closer to home. "The D.C. area has traditionally been a hotbed for traditional bluegrass music. We have many nationally known bluegrass bands. We even have a bluegrass camp in Maryland," says Deming. Until then, he will continue to attend weekly jam sessions with a Bowie-based group which includes Annen. His goal is "to be in a local group and play the banjo for beer." He has no desire to make recordings. Deming observes that "I'm a simple-minded person. I like simple melodies and old-fashioned music. I don't like complex, modern bluegrass that sounds almost like jazz." He plays a Deering Sierra banjo, which he describes as "a professional model banjo without the fancy inlays."

He also points out a NASA connection to banjos. According to Deming, "I have heard that there is a NASA developed aluminum that is used in banjo tone rings because of its unique resonance properties. The tone ring is placed under the head of the banjo to add mass and therefore more resonance. Resonance enhances the tones, which is all important within the banjo community."

Deming concludes that "Banjo experts can tell one twang from another. There are certain kinds of twangs that are highly favored and others that are not." His three house cats disagree; they all leave whenever he plays. More than anything, Deming finds that playing the banjo is relaxing. Says Deming, "If I haven't played the banjo for a few days, I know I'm working too hard. There is usually nothing I can do about it, but at least I'm aware." ■

Paid to Have Fun

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The M3 measures broad wavelengths of light, displaying a different spectrum for each mineral. By comparing the measured spectra to the spectra of minerals in lunar samples or minerals on the Earth, they can identify what the surface of the Moon is made of.

Petro's exciting M3 research is funded by NASA's Discovery program, which conducts low cost but highly focused planetary science investigations designed to better understand the solar system. NASA's Jet Propulsion Laboratory, located in Pasadena, Calif., manages the M3 mission.

One of the biggest surprises from M3 was the discovery of water on the Moon. Data from M3 and two other missions confirmed that water is found across much of the lunar surface, a finding that surprised the entire M3 team. That finding is just one in a long list of new discoveries that is showing us that the Moon is far from well understood.

"I discovered at an early age that all rocks are cool and have stories to tell. Now I cannot believe that I am able to participate in NASA discoveries on other planets", stated Petro.

Although Petro is a very motivated researcher, he has just stepped into another important role as a first time father of little Liam. The tiny cries are having a big influence in his life right now as he sets off on the new frontier of parenthood. He is looking forward to introducing Liam to the fun in science with the help of his wife Jennifer. ■

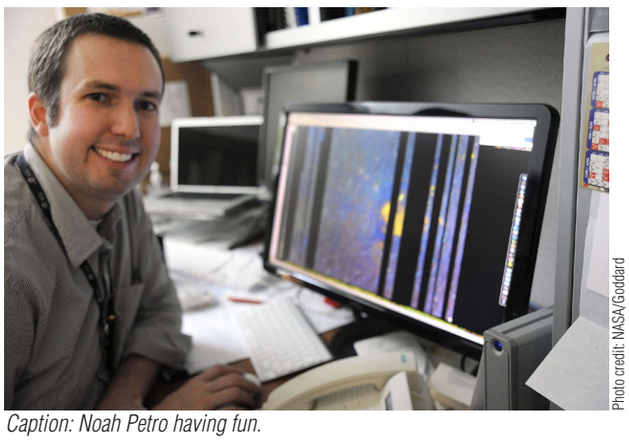

Photo credit: NASA/Goddard

Caption: Noah Petro having fun.

i am **goddard**: Curtis Johnson

By Christina Coleman

The daunting task of being responsible for 1,200 Applied Engineering and Technology Directorate (AETD) employees in Code 500 and making sure they are executing the work force plan is already challenging for a manager. Add the task of financial management of the in-house deliverables such as the *Astro-H* Advanced Topographic Laser Altimeter System (ATLAS), the Fast Plasma Instrument (FPI), and the Soil Moisture Active Passive (SMAP) instrument, and you've got a full plate. But Curtis Johnson, Chief of the AETD Business Management Office, doesn't think that's enough.

Photo credit: NASA/Goddard/Pat Izzo

Caption: Curtis Johnson.

By **understanding the current culture and environment**, Johnson believes he can grasp the bigger picture in order to carry out the mission of Goddard and in turn, the Agency as a whole. His thirst for knowledge and a desire to keep a finger on the pulse of Goddard is paramount.

"I think you need to be a well-rounded individual. If you want to excel at your job you need to be. You become more aware, you become more satisfied, you become more invested, you become more productive, you become more Goddard."

In other words, Johnson is a perfect addition to the "i am **goddard**" campaign. He exhibits the unique and inclusive environment of the Center and his efforts in understanding every aspect of production contribute to the success of not only his Division office, but the Center as a whole.

Johnson, who started off as a co-op, believes in fostering and sustaining relationships with different Directorates and other Centers as well. He credits his rotations between the budget office and accounting while he was a co-op in helping him build lasting connections; connections that have allowed him to identify and tackle challenges and efficiently do his job. His diversity efforts on Center help him recognize the contributions of other individuals while getting a broad view of what is going on.

Johnson volunteered to be a part of the Power and Privilege design team. After participating in the *Power and Privilege: Race* session last year, Johnson said he felt "energized and wanted to make a difference."

Since then, Johnson has accepted the opportunity to participate in the AETD Diversity Council and he is an alternate for the Center's Diversity Council. He is also training to become a Diversity Dialogue facilitator and is developing a pilot outreach-educational training program with the University of Puerto Rico, Rio Piedras Campus for students called "I Want to Be Goddard."

"I believe in volunteering because, although we have assigned roles, we need to work outside of that to give back to the Goddard community," he said. "Becoming involved in diversity efforts, keeping in close contact with people you used to work with, and recognizing I need to give back is how I understand the current culture and environment."

In his spare time, Johnson enjoys running marathons. Currently, he holds three ultra-marathon (greater than 26.2 miles) medals; two for 50-milers and one for a 31-mile marathon. He is considering participating in a 100 kilometer (62.1 mile) race in February of 2011. Johnson says chocolate is his favorite ice cream flavor. He is, however, a self-proclaimed "cupcake connoisseur," and collects them when he travels.

This University of Maryland, College Park alumni also loves reality television and has submitted applications and video submissions to be featured on *Survivor*, *Big Brother*, and *The Amazing Race*. Most recently, Johnson has submitted an application for The Learning Channel's reality television show *What Not to Wear*.

Photo provided by Curtis Johnson.

Caption: Curtis Johnson's photo submission to What Not to Wear.

"Although I may not be accepted," he said, "the experience was fun and creative and provided me with the opportunity to use different skills. There is also something that can be learned from any experience." ■